Smithsonian's Ocean Science Initiative: a partnership between the National Museum of Natural History (NMNH) and the National Oceanic and Atmospheric Administration (NOAA)

Sharon Katz Cooper
National Museum of Natural History, Smithsonian

Carol Fiertz
National Museum of Natural History, Smithsonian

Joanne Flanders
National Oceanic and Atmospheric Administration

Jill Johnson
National Museum of Natural History, Smithsonnian

Tom La Pointe
National Oceanic and Atmospheric Administration

Abstract - **This paper presents the Smithsonian National Museum of Natural History's Ocean Science Initiative, which includes an Ocean Web Portal, a Center for Ocean Science, and its centerpiece - what will become the nation's largest permanent Ocean Hall exhibit. NMNH is the most visited natural history museum in the world. Its dynamic team and unparalleled collections, in combination with NOAA's knowledge and expertise in ocean science, creates an environment that allows for development of a unique exhibit and supporting programs. This special session will focus on the partnership, the Hall, its development process, and evolving education and web portal plans.**

I. INTRODUCTION

Upon completing a comprehensive 2003 study, the independent Pew Oceans Commission [1] announced, "Our oceans are in crisis. . . .What we once considered inexhaustible and resilient is, in fact, finite and fragile." The U.S. Commission on Ocean Policy [2], a presidentially appointed panel, concurred in its recent report. Both commissions have called for a new era of ocean literacy that links people to the marine environment and builds national support for the health of our oceans. The Bush Administration's U.S. Ocean Action Plan [3] also highlights the importance behind wise management of the global ocean and the urgent need for an ocean ethic. To quote the U.S. Commission, "Perhaps most important, people must understand the role the oceans have on their lives and livelihoods and the impacts they themselves have on the oceans." The Smithsonian Institution's National Museum of Natural History (NMNH) in partnership with the National Oceanic and Atmospheric Administration (NOAA), is ideally positioned to respond to this call to action to contribute to a new era of ocean literacy.

From 2003 to the present, Congress provided support for raising ocean literacy through a partnership between NOAA and NMNH to build a new ocean exhibit. The NMNH is the most visited natural history museum in the world with world renowned collections and highly talented designers. NOAA is a global leader in oceanic and atmospheric research, the steward of national coastal and marine environments and a provider of information products. This integration of research and high-quality exhibits and merger of products and educational materials, provides for a unique partnership and is designed to raise ocean science literacy to new levels.

II. THE OCEAN HALL

A. Statement of Purpose and Goals

A Statement of Purpose was developed in 2003 for a major exhibition hall on the ocean at NMNH. It sets forth a plan that will present the ocean as never displayed before. The exhibition will also serve as the cornerstone for a national outreach program that will educate citizens about the ocean and encourage them to become better stewards of this critical component of Earth's life support system.

Building on visitors' natural curiosity about the ocean and on the love of exploration and discovery that is part of the human spirit, the Ocean Hall will invite visitors to become ocean explorers. From the moment they enter this 23,000 square foot exhibition space, visitors will feel submerged in the unfamiliar ocean world. As they navigate the exhibit, they will use some of the same methods, collections, and technologies used by scientists to learn about this mysterious realm. And when they emerge, they will be transformed and committed to continuing their self-driven exploration about our ocean world.

The main message for the Ocean Hall is:

The ocean is a global system that is essential to ALL life, including yours.

The major educational goals for the hall are:

- to inspire awe for how vast, diverse, and unexplored the ocean is, and for how fundamentally different it is from land;
- to provide a unique and engaging experience that demonstrates how the ocean works and how it is interconnected with other global systems;
- to demonstrate how life evolved in the ocean over billions of years and changed dramatically over time;

- to instill in visitors an awareness of the great diversity of ocean habitats and ocean life, and of how much is still being discovered;
- to inform visitors about exciting technologies and other approaches used by scientists and ocean explorers to uncover the ocean's mysteries; and,
- to inspire and empower visitors to make the connection between the ocean and their daily lives, and to encourage them to continue exploring the ocean and to help conserve it.

B. 65% Design Phase

At the 65% design development phase the exhibit is drawing from the Museum's vast collection of modern and fossil specimens and combining with cutting-edge technologies from NOAA's many diverse line offices to introduce the global ocean and how it functions, its inhabitants—past and present, and a diversity of ocean ecosystems. The design is a seamless one with major themes interwoven and reinforced throughout all major sections of the exhibition.

Highlights of the hall include an entry experience full of the diversity of modern marine life, including large media screens on either side reinforcing the ocean as a dynamic, interconnected, constantly changing, global system. The centerpiece of the hall is a full scale model of a North Atlantic Right Whale in a feeding pose that serves as a crossroads to the other major sections of the exhibit. A journey through time gallery explores the ocean from its earliest beginnings up to the present ; an open ocean gallery explores the vertically-stacked ecosystems hundreds of miles offshore, from top to bottom. A coastal gallery explores several ocean ecosystems from the poles to the beach. The ocean systems gallery facilitates learning about the ocean as a global system and the interconnected components of ocean physics, chemistry, biology, and geology, as well as ocean and atmosphere interactions. Finally, visitors will explore what it takes to live on an ocean planet—focusing on ocean and human interactions over time.

II. NOAA Partnership

In the summer of 2004, the Smithsonian completed 35 percent of the Hall's design and it underwent formal review by NOAA. The 35 percent design provided the first glimpse of the floor plan based on thematic areas, and potential exhibitry and interactives. Design documents were reviewed by NOAA in tandem with Smithsonian staff for concept clarity and accuracy, with an eye toward featuring the most illuminating and engaging stories. NOAA's key comments were incorporated into the evolving design and included further development of ocean systems content to include ocean atmosphere interplay and circulation dynamics; the stewardship theme; and the ecosystem concept.

A. Specialized NOAA Products

In addition to satellite imagery, benthic habitat maps, artifacts, and imagery contributions, NOAA and other partners offered a number of original products for potential inclusion in the Hall, including "Science On a Sphere" – the use of cameras and high-intensity lights to project an image of the Earth as if from 22,000 miles above its surface; an interactive Ocean News Kiosk; a hydrothermal vent field fly-through using a mosaic of actual images draped over detailed bathymetric data; a new animation depicting global ocean circulation; the use of Internet2 live-feed in the Hall so deep sea ocean exploration expeditions can be viewed by visitors in real-time; and co-development of a major Web portal that will reach and educate a broad user community.

Fig. 1 : NOAA's Science on a Sphere

B. Technology Opportunities

The Ocean Hall also provides a venue for technology displays in several galleries. There may be changeable "Field Stations" which feature research and tools of contemporary researchers; "How We Know" exhibits that highlight platforms and processes used to study the ocean; and a deep sea exploration display that illustrates cutting edge exploration tools. Additionally, the use of live audio and video feeds – such as real-time connections to ocean expeditions at sea, may be piped into the Hall and/or the Baird Auditorium for special events and school programs, and lecture series may be held as part of the OSI.

C. Long Term Partnership

As the Hall design evolves, NOAA's collaboration with the Smithsonian will continue to evolve as well. In 2006 and 2007, specialized agency products, artifacts and imagery ultimately selected for the Hall will be gathered and produced.

The Ocean Hall is scheduled to open in September 2008 and NOAA and the Smithsonian are committed to ensuring it remains current throughout its 30-year lifetime. NOAA will seek future support to keep the Hall current and as advances in science, communications and technology continue, the Ocean Hall and the Smithsonian's Ocean Science Initiative will deliver discoveries and mysteries, and the meanings behind them, to learners of all ages.

III. Ocean Education

To complement the Hall and other Ocean Science Initiative components, NMNH – along with NOAA and other partners – is planning a series of educational initiatives. These initiatives will include new projects and products as well as incorpration of ocean themes into existing educational programs, with the aim of creating a nationwide hub for ocean education activities.

A. NMNH Education Principles and Rationale

As defined by a national ocean literacy initiative [4], ocean literacy is **an understanding of the ocean's influence on you and your influence on the ocean**. An ocean-literate person understands the fundamental concepts about the functioning of the ocean, can communicate about the ocean in a meaningful way, and is able to make informed and responsible decisions regarding the ocean and its resources.

The vision of NMNH's ocean education program is to make a significant impact on ocean literacy nationwide by creating exciting and innovative programs that bring ocean science and ocean education resources to ever-expanding audiences. The museum's ocean education programs will do this by providing creative professional development, facilitating networks of educators, promoting family learning and using its resources to advance the goals of the Ocean Science Initiative for all target audiences, including educators and their students, parents, scientists, other informal educators, families and the general public. In addition, the Museum will become a forum and educational center for the discussion of ocean conservation issues, threats, and opportunities, convening scientists, educators, and decision-makers in an effective dialogue about human interactions with the ocean.

Drawing from NMNH's overall mission to engage and educate young minds and inspire future generations of scientists, conservationists and policymakers, the ocean education programs of the museum aim to build capacity for our audiences to engage in inquiry about the ocean. The goal is that these experiences will build an appreciation and love of oceans that will lead to concrete behavioral and attitudinal change and make a real difference in stewardship and conservation of the oceans.

B. Program Principles

The ocean education program will advance ocean literacy by supporting both Ocean Hall goals and these nationally recognized essential principles, which parallel the Hall's goals closely:

- The earth has one big ocean with many features.
- The ocean and life in the ocean shape the earth.
- The ocean is a major influence on weather and climate.
- The ocean makes the earth habitable.
- The ocean supports a great diversity of life and ecosystems.
- The ocean and humans are inextricably connected.
- The ocean is largely unexplored.

Guiding Principles

NMNH's ocean education activities will support NMNH's and the Smithsonian's mission and strategic goals, build on NMNH's unique resources of people, research and collections, provide materials and programs that address the goals of the Ocean Hall and Ocean Science Initiative, incorporate and promote object and inquiry-based learning, align with standards of learning, and include clear and measurable objectives and evaluation components. They will also seek to create models that are replicable in other settings, make appropriate use of technology, create a sense of personal responsibility and action for conservation, stewardship and future exploration that will connect with all ages from preschool to senior citizen.

The museum's ocean education programs will be developed in collaboration with strategic partners, provide opportunities for truly cross-disciplinary thinking and problem-solving, encourage linkages between physical, chemical, geological, and biological sciences as well as social studies, humanities, arts, and mathematics, provide opportunities for land-locked classrooms and under-represented groups, link to uses of real-time scientific data in classrooms, and encourage future scientists by exposing students to diverse career opportunities related to the ocean and natural history.

C. A Proposed Plan

Towards these goals, NMNH and NOAA co-sponsored an Ocean Hall Education and Outreach Summit in February, 2005. This summit brought together about 100 leaders in ocean education from around the country. During two days of discussions, several big ideas emerged. One of these was a need for national leadership, particularly in the realm of professional development. Since that time, the Office of Education has been developing a broad plan for its ocean education programs, a feature of which is a national professional development center. Note that this plan is still very much in its formative stages.

An emerging idea is the NMNH Learning Laboratory for Ocean Education. As a learning laboratory, this center is meant to be a place for experimenting with new ideas and actively investigating ways to refine them. The Learning Laboratory will consist of three main components, all of which will be closely linked to each other – the Center for Professional Development, the Center for Family Learning, and Visitor Programs. Each component will include both in-museum and electronic outreach features. The Center for Professional Development will target educators (broadly defined), and will offer educator (both formal and informal) and scientist institutes throughout the year. Partnering with appropriate organizations who have high-quality, recognized materials and data resources in the field, NMNH will design institutes that bring together the partner's expertise and that of NMNH. The Center for Family Learning will focus on the needs of families and intergenerational groups, assisting them in utilizing the museum for engaging learning opportunities throughout the lifespan. Visitor Programs will encompass offerings for the general visitor.

The Goals of this Learning Laboratory are:

- To provide a national center for ocean-related professional development.
- To provide a model for inquiry-centered use of museum resources by educators and families and a learning laboratory for experimentation with these resources.
- To create a community for ocean-related lifelong learning opportunities.

1) The Center for Professional Development

The Center for Professional Development will offer summer educator workshops. Each workshop will be co-sponsored by another organization which has produced curricula, materials, and/or data, for which educator training is needed. NMNH would contribute its expertise in exhibits, collections, research, and museum education techniques to each workshop.

Educator participants will have an opportunity for ongoing follow-up and support through electronic means such as listservs, chat rooms and video conferences. They will be invited to return in subsequent years, to expand on their projects, share ideas and concerns, and learn additional ocean science concepts.

Educators worldwide will have access to educator ideas and projects, which will be posted on-line, once reviewed by NMNH staff.

2) The Center for Family Learning

Family learning experiences are important and often overlooked components of lifelong learning. In addition to the insights that intergenerational learning can spark, families that learn together strengthen their own bonds and build shared interests. Museums like NMNH are prime locations for family experiences and the museum has many opportunities to raise the level of these

experiences and provide links to further explorations. The Center for Family Learning will offer general and targeted family workshops to provide parents with resources and model ways in which they can more effectively use the museum for inquiry-generating experiences.

3) Visitor Programs

NMNH receives more than 6 million visitors to its exhibits each year and expects large crowds for its high-profile Ocean Hall. Providing engaging and educational experiences to these visitors to enhance their use and enjoyment of the Ocean Hall will therefore be central to education plans.

The Office of Education will offer ocean-related public programs to enhance the exhibit experience for the average visitor, provide opportunities for inquiry-based learning, and provide resources for further investigation, including print and on-line opportunities.

These programs will likely include school and family programs in the Discovery Room, Insect Zoo and Naturalist Center, IMAX-film-related teacher resources, docent-led tours, ocean-related public lecture series, in-exhibit interactive cart programs, an Ocean Explorer brochure for the Hall, an Ocean Hall website with links to further resources, ocean family festivals, and a variety of publications for children and adults.

IV. The Web Portal

Museums have learned to embrace the Internet as another means of educating the public and promoting their programs. They are building a solid track record of increasing visitorship by providing interesting and relevant content as well as using intriguing interactive technologies, in particular for online exhibits. Museums are a trusted source for information, particularly for educators. These trends also hold true at NMNH. In fact, NMNH today receives more visitors on-line than walk through the museum doors – roughly 8 million per year vs. 6 million. Overall the combined Smithsonian websites welcome more than 85 million visitors annually with the NMNH websites among the top most-visited Smithsonian sites. NMNH's deep content spans multiple natural history disciplines and reaches a wide variety of users from all walks of life and levels of interest and expertise. Consistent among the top most visited NMNH sites and pages are those presentations where we have successfully leveraged the educational link between the museum's outreach and its research. Popular sites such as *Mammal Species of the World*, *Vikings: North Atlantic Saga*, and *Global Volcanism* continue to be models for increased web visitors and greater public and educational impact.

NOAA has used the Web from its earliest beginnings as a critical medium for distributing an extensive array of data and information products. The NOAA.GOV domain is one of the most widely visited domains in the government.

With over 800 individual Web sites, NOAA's Web offerings are truly vast. They range from real time and near real time oceanographic data, statistical data on fish populations, coastal population, long term water quality, chronicles of oceanographic expeditions and management programs for marine protected areas, to a wide variety of educational programs and products. NOAA's Web offerings have true immediacy in times of major natural emergencies, such as hurricanes and storm surges. In these periods, information posted on NOAA's Web sites and updated around the clock, has lifesaving value.

Thus, these two institutions, each with long but very different histories and experiences with the Web, will work as one and with one vision in developing the Ocean Web Portal to foster ocean literacy.

A. Why Develop the Portal?

People have many motivations for their individual interests in the ocean. Some are engaged with science and continuing discoveries. Others are fascinated with the mysterious life forms that have evolved in this alien watery world. Still others are passionate about preserving this natural environment. Some pursue their livelihood on the ocean, working long and hard days reaping the ocean's bounty, transporting goods, and protecting our coastal waters. And still others use the ocean for recreation, enjoyment, and personal fulfillment.

Interest has never been higher in ocean resource science and management in government arenas. Recent blue ribbon reports by the U. S. Commission on Ocean Policy and Pew Commission have put into clear focus the critical importance of managing ocean areas for the common good.

There already exists a community of millions with keen interest in learning more about our ocean realm and what they can do, as a world, as a nation and as individuals, to ensure that these benefits continue indefinitely. The Ocean Web Portal, as a companion to the Ocean Hall, is an unprecedented opportunity to truly engage and inform the public. The institutional framework for its inception is in place.

The Smithsonian Institution has unparalleled strengths in engaging this interest and raising public awareness of the complete panoply of the ocean world, ocean science, and ocean governance. NOAA brings operational and management expertise and responsibilities that range from oceanic scales to local levels. Together, both institutions bring complimentary networks of oceanographic and ocean education organizations that can be leveraged as collaborating contributors.

B. Who Is the Target Audience?

Our primary audience is the general public. The Smithsonian has many decades of experience in presenting science in an engaging and understandable way to this audience. The Web Portal, however, will not stop there. It will also provide information useful to educators, students, policy-makers, ocean travelers and tourists, and industry leaders. By integrating the ocean-related collections and research data, it will also support natural history researchers around the world including ecologists, conservationalists, and naturalists.

For the general public and for the educational community, the Smithsonian and NOAA are trusted names. The NMNH Web site's visitorship has been growing steadily over the past several years. Information distributed through our Web presence will be seen and trusted by millions.

C. What Is the Portal? What Will Be Included?

The partnership's vision of the Portal is inclusive. The team recognizes that even with the depth of NMHH/NOAA marine expertise, most marine expertise exists beyond the Smithsonian and NOAA.

For the portal, NMNH's mission requires the project to reach out beyond the museum's walls to a broad array of scientific, educational, and resource management experts, and to effectively translate their wisdom, information, experiences, and knowledge so that it can be truly appreciated by portal visitors. The team will aggressively seek out content contributors and collaborators from the national and international ocean community.

Planning for the Web Portal is just beginning. The project's goal is to have a full initial plan with specific content sections by the summer of 2006. In these very preliminary stages the team has identified several components of the Portal:

- The on-line Exhibit. This will be an on-line experience to mirror the Hall. Recent on-line exhibits use interactive technologies and elegant design to enhance the user experience.
- Educational Materials. These will include the electronic components of education programs mentioned earlier.
- Collections. The wealth of the Smithsonian is in its vast and diverse collection. NMNH has over 126 million specimens in its collection. Thirty-three million of these relate to the ocean. NOAA will add additional historical and contemporary collections from its spectrum of oceanographic activities.
- Field Guides. These will guide the public through the identification of marine life forms.
- Stories. Both NOAA and NMNH have many stories of ocean adventures and discoveries that can enrich the public. These stories will be designed to part the institutional drapery that often keeps the public one step removed, and guide visitors behind the scenes.

Other components such as "what if" interactive games, a section on ocean mysteries, access to other data sources, and ways in which people can actively participate have also been identified as possibilities.

D. What Will Be the Initial Steps in Developing the Portal?

The Web Portal will be developed over the next three and a half years. A core planning team of NMNH and NOAA content and Web experts has been assembled to guide this process. One of the first items of business for the core team will be to develop a list of organizations whose ideas and /or content should be proactively sought out. Appropriate vehicles for gathering these collective insights will also be examined. This organizational outreach will be a major effort of the initial year, when Web Portal planning is the focus of the effort.

References

[1] Pew Oceans Commission. 2003. *America's Living Oceans: Charting a Course for Sea Change*. A Report to the Nation. May. Pew Oceans Commission, Arlington, VA. **http://www.pewoceans.org/oceans/index.asp**

[2] 2004. An Ocean Blueprint for the 21st Century, Final Report of the U.S. Commission on Ocean Policy. Washington, D.C., 2004. ISMB#0-9759462-0-X. **http://www.oceancommission.gov**

[3] 2004. **http://ocean.ceq.gov/actionplan.pdf**

[4] F. Cava, S. Schoedinger, C. Strang and P.Tuddenham. *Ocean Literacy: The Essential Principles of Ocean Sciences, K-12*. Washington, DC: National Geographic Society, 2005.